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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2018-1017; Special Conditions No. 25-741-SC]

Special Conditions: Boeing Model 777-9 Airplanes; Post-Crash Fire Survivability, Airplane Level of Safety Provided by Composite Fuel-Tank Structure

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for The Boeing Company (Boeing) Model 777-9 airplane. This airplane will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport-category airplanes. This design feature is composite fuel-tank structure as it relates to post-crash fire survivability. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: This action is effective on Boeing on [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Send comments on or before [INSERT DATE 45 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: Send comments identified by Docket No. FAA-2018-1017 using any of the following methods:

- *Federal eRegulations Portal:* Go to <http://www.regulations.gov/> and follow the online instructions for sending your comments electronically.
- *Mail:* Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.
- *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket Web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the *Federal Register* published on April 11, 2000 (65 FR 19477-19478).

Docket: Background documents or comments received may be read at <http://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Suzanne Lucier, Propulsion and Mechanical Systems Section, AIR-672, Transport Standards Branch, Policy and Innovation Division, Aircraft Certification Service, Federal Aviation Administration, 2200 South 216th Street, Des Moines, Washington 98198; telephone and fax 206-231-3173; e-mail suzanne.lucier@faa.gov.

SUPPLEMENTARY INFORMATION: The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions is impracticable because the substance of these special conditions has been published in the *Federal Register* for public comment in several prior instances with no substantive comments received. Therefore, the FAA has determined that prior public notice and comment are unnecessary, and finds that, for the same reason, good cause exists for adopting these special conditions upon publication in the *Federal Register*.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On March 12, 2015, Boeing applied for an amendment to Type Certificate No. T00001SE to include the new 777-9 airplane. This airplane, which is a derivative of the Boeing Model 777 airplane currently approved under Type Certificate No. T00001SE, is

a twin-engine, transport-category airplane with seating for 495 passengers and a maximum takeoff weight of 775,000 pounds.

Type Certification Basis

Under the provisions of title 14, Code of Federal Regulations (14 CFR) 21.101, Boeing must show that the Model 777-9 airplane meets the applicable provisions of the regulations listed in Type Certificate No. T00001SE, or the applicable regulations in effect on the date of application for the change, except for earlier amendments as agreed upon by the FAA.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Boeing Model 777-9 airplane because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the Boeing Model 777-9 airplane must comply with the fuel-vent and exhaust-emission requirements of 14 CFR part 34, and the noise-certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.101.

Novel or Unusual Design Features

The Boeing Model 777-9 airplane will incorporate the following novel or unusual design feature:

Composite fuel-tank structure as it relates to post-crash fire survivability.

Discussion

As with previous applicant airplane designs with underwing-mounted engines, the wing tanks and center tanks are located in proximity to the passengers and near the engines. Experience indicates post-crash survivability is greatly influenced by the size and intensity of any fire that occurs. Tests conducted at the FAA Technical Center have shown the ability of aluminum wing surfaces to withstand post-crash fire conditions. These tests have verified adequate dissipation of heat across wetted aluminum fuel-tank surfaces so that localized hot spots do not occur, thus minimizing the threat of explosion. This inherent capability of aluminum to dissipate heat also allows the wing lower surface to retain its load-carrying characteristics during a fuel-fed ground fire. These properties significantly delay wing collapse and burn-through for a time interval that usually exceeds evacuation times. In addition, as an aluminum fuel tank is heated with significant quantities of fuel inside, fuel vapor accumulates in the ullage space, exceeding the upper flammability limit relatively quickly, and thus reducing the threat of a fuel-tank explosion prior to fuel-tank burn-through. The service history of conventional aluminum airplanes has shown that fuel-tank explosions caused by ground fires have been rare on airplanes

configured with flame arrestors in the fuel-tank vent lines. Fuel tanks constructed with composite materials, a new technology, may or may not have equivalent capability.

Current regulations were developed and have evolved under the assumption that wing construction would be of aluminum materials, which provide inherent properties. Current regulations may not be adequate when applied to airplanes constructed of different materials.

Aluminum has the following properties with respect to fuel tanks and fuel-fed external fires.

Aluminum is highly thermally conductive. It readily transmits the heat of a fuel-fed external fire to fuel in the tank. This has the benefit of rapidly driving the fuel-tank ullage to exceed the upper flammability limit prior to burn-through of the fuel-tank skin, or heating of the wing upper surface above the auto-ignition temperature. This greatly reduces the threat of fuel-tank explosion.

Aluminum panels at thicknesses previously used in wing lower surfaces of large transport-category airplanes have been fire resistant as defined in 14 CFR part 1, and Advisory Circular (AC) 20-135, "Powerplant Installation and Propulsion System Component Fire Protection Test Methods, Standards and Criteria."

The heat-absorption capacity of both aluminum and fuel prevent burn-through and wing collapse for a time interval that generally exceeds the passenger evacuation time.

The extensive use of composite materials in the design of the Boeing Model 777-9 airplane wing and fuel-tank structure is considered a major change from conventional and traditional methods of construction. The applicable airworthiness

regulations do not contain specific standards for post-crash fire-safety performance of wing and fuel-tank skin or structure.

To provide the same level of safety as exists with conventional airplane construction, the applicant must demonstrate that the airplane has sufficient post-crash survivability to enable occupants to safely evacuate in the event that the wings are exposed to a large fuel-fed fire. Factors in fuel-tank survivability are the structural integrity of the wing and tank, flammability of the tank, burn-through resistance of the wing skin, and the presence of auto-ignition threats during exposure to a fire. The FAA assessed post-crash survival time during the adoption of Amendment 25-111 for fuselage burn-through protection. Studies conducted by and on behalf of the FAA indicated that, following a survivable accident, prevention of fuselage burn-through for approximately 5 minutes can significantly enhance survivability. (See report numbers DOT/FAA/AR-99/57 and DOT/FAA/AR-02/49.) Research reveals little benefit in requiring wing-skin design to prevent wing-skin burn-through beyond five minutes, due to the effects of the fuel fire itself on the rest of the airplane. That assessment was carried out based on accidents involving airplanes with conventional fuel tanks, and considering the ability of ground personnel to rescue occupants. In addition, AC 20-135 indicates that, when aluminum is used for fuel tanks, the tank should withstand the effects of fire for 5 minutes without failure. Therefore, to be consistent with existing capability and related requirements, the applicant airplane fuel tanks must be capable of resisting a post-crash fire for at least 5 minutes. In demonstrating compliance, the applicant must address a range of fuel loads from minimum to maximum, as well as any other critical fuel load.

These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Applicability

As discussed above, these special conditions are applicable to the Boeing Model 777-9 airplane. Should Boeing apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, these special conditions would apply to that model as well.

Conclusion

This action affects only a certain novel or unusual design feature on one model of airplane. It is not a rule of general applicability.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

Authority Citation

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Boeing Model 777-9 airplanes.

In addition to complying with 14 CFR part 25 regulations governing the fire-safety performance of the fuel tanks, wings, and nacelle, the Boeing Model 777-9 airplane must demonstrate acceptable post-crash survivability in the event the wings are

exposed to a large fuel-fed ground fire. Boeing must demonstrate that the wing and fuel-tank design can endure an external fuel-fed pool fire for at least 5 minutes. This must be demonstrated for minimum fuel loads (not less than reserve fuel levels) and maximum fuel loads (maximum-range fuel quantities), and other identified critical fuel loads. Considerations must include fuel-tank flammability, burn-through resistance, wing structural-strength-retention properties, and auto-ignition threats during a ground-fire event for the required duration.

Issued in Des Moines, Washington, on February 19, 2019.

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